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Research Letter

Gait Speed and Pedestrian Crossings in COPD

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CNM and SSCK contributed equally to this study. Substantial contributions to the conception and design of the study: WM, SSCK, MM; substantial contribution to the acquisition of Data: CN, SSCK, SP, SEJ, REB; Analysis and interpretation of the data: CMN, SSCK, MIP, MM, WM; First draft of the manuscript: CMN, SSCK, MIP, MM, WM; Revision of the manuscript critically for important intellectual content: All authors; Approval of the final manuscript: All authors; Accountability for all aspects of the work: CN, SSCK, WM.

ABSTRACT

The assumed minimum walking speed at pedestrian crossings is 1.2 metres per second (m/s). In this prospective cohort study, usual walking speed was measured over a four-metre course in 926 community-dwelling, ambulatory patients with stable COPD. Mean (SD) walking speed was 0.91 (0.24)m/s with only 10.7% walking at a speed equal or greater than 1.2m/s. In order for 95% of this cohort to safely negotiate a pedestrian cross, traffic lights would have to assume a minimum walking speed of 0.50m/s (2.4 times longer than current times). The current assumed normal walking speed for pedestrian crossings is inappropriate for COPD patients.

INTRODUCTION

In many countries, including the United States, Canada, Ireland, Australia, South Africa and the United Kingdom, pedestrian crossings assume a minimum walking speed of 1.2 metres per second (m/s) - equivalent to 4 feet per second.^{1,2} Recent epidemiological studies have shown a significant proportion of older adults in the UK and Ireland walk slower than 1.2m/s,^{1,2} whilst more than half of all pedestrians killed on the road are over 65 years of age despite this age group representing less than 20% of the population.³ With an ageing population, there are concerns that insufficient time to negotiate pedestrian crossings safely will become an increasing public health problem.³

Patients with chronic obstructive pulmonary disease (COPD), in whom exertion-related breathlessness and exercise intolerance are common, may be particularly vulnerable. The aim of our study was to assess normal walking speed in a cohort of community-dwelling, ambulatory patients with stable COPD. We hypothesised that only a small minority of patients with stable COPD would have walking speeds greater than 1.2m/s.

METHODS

This was a prospective cohort study and data was collected between November 2009 and October 2013 in patients recruited from community- and hospital-based respiratory and pulmonary rehabilitation clinics at Harefield Hospital, UK. Inclusion criteria included a diagnosis of COPD according to GOLD guidelines, ambulatory (defined as leaving the house at least once a week and able to walk 10 metres independently) and stable disease (no change in medications in previous 6 weeks). Usual walking speed was measured as the four metre gait speed (4MGS) with a standing start as previously described.⁴⁻⁷ Other

measurements recorded included forced expiratory volume in one second (FEV₁), the Medical Research Council dyspnoea scale (MRC) and the incremental shuttle walk test (ISW).

RESULTS

We asked 972 patients to consider participating in the study: 38 declined to participate (n=15: family commitments, n=10: not interested in research, n=9: no reason provided, n=4: miscellaneous reasons) and 9 did not meet the study inclusion criteria (n=6: recent change in medication, n=3: unable to walk 10 metres). Data was available in 926 patients (548 men; 378 women). Baseline characteristics were expressed as mean (standard deviation): age 69 (10) years, FEV₁ 49.8 (20.9) %, MRC 3.3 (1.1), ISW 223 (150) metres and 4MGS 0.91 (0.24)m/s. 4MGS was weakly related to age ($r=-0.21$), FEV₁ %predicted ($r=0.11$); moderately with respiratory disability (MRC: $r=-0.51$) and strongly with exercise capacity (ISW: $r=0.78$); all $p<0.001$. Frequency distribution of 4MGS for the cohort is shown in Figure 1, demonstrating that only 10.7% had a walking speed equal to or greater than 1.2m/s.

DISCUSSION

Our cohort of ambulatory patients with stable COPD had significantly slower walking speeds than age-matched healthy people,⁸ but were faster than those at discharge following a hospitalized acute exacerbation of COPD.⁶ Slow walking speed was associated with increasing age, worse lung function, increasing respiratory disability (MRC) and decreased exercise tolerance (ISW).⁵

UK pedestrian crossing timings assume a minimum walking speed of 1.2m/s, yet only 10.7% of our cohort with stable COPD would have sufficient time to walk across a pedestrian crossing safely. In order to accommodate at least 95% of our cohort, pedestrian crossings would have to assume a minimum walking speed of 0.50m/s, resulting in traffic lights having to stay red 2.4 times longer than current times.

A limitation of the study is that gait speed measurements were carried out indoors, on a flat undisturbed four-metre walking course in a controlled outpatient setting. This may not reflect real-life conditions at pedestrian crossings such as the weather, road and pavement surface quality, varying walk distances, interactions with other pedestrians, and driver behaviour. Therefore, it is possible that our gait-speed measurement actually overestimates real-life walking speed at a pedestrian crossing. In contrast, it could also be argued that with the visual or auditory feedback at a pedestrian crossing, patients with COPD and a degree of functional reserve, may adopt a walking speed closer to maximum, rather than usual, gait speed. These opposing effects may cancel each other out, and we propose that our estimate of the proportion of patients affected by current pedestrian crossing times remain valid.

Further work is required to assess whether the discrepancy between pedestrian crossing times and patients' walking speed may influence engagement in physical activity, a significant modifiable prognostic risk factor.⁹ Inability to negotiate the local environment may deter patients from engaging in physical or social activities outside their home. Indirect evidence to support this includes the previously described association between slow gait speed and reduced objectively measured physical activity levels in outpatients with COPD.¹⁰ Our data would support a review of pedestrian crossing times, as well as the evaluation of

other solutions to improve pedestrian safety, including extended pushbuttons, countdown timers and pedestrian infrared detectors.

In summary, approximately 90% of stable outpatients with COPD have a walking speed below the minimum walking speed assumed by pedestrian crossings. Currently assumed normal walking speed for pedestrian crossings is inappropriate for patients with COPD.

FIGURE LEGEND:

Figure 1.

Frequency histogram of four metre gait speed (4MGS) in a cohort of 926 ambulatory patients with stable COPD. Dotted line indicates the minimum walking speed assumed by pedestrian crossings (1.2 metres per second (m/s)).

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